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ST MARY'S CHURCH, BRAMFORD, SUFFOLK
TREE-RING ANALYSIS OF TIMBERS FROM THE TOWER AND SPIRE

SCIENTIFIC DATING REPORT

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Summary

Assessment of the timbers of the spire revealed that none of them contained sufficient rings to make them suitable candidates for dendrochronological dating. Of the timbers sampled in the structures at the top of the tower, two pairs of timbers matched each other, and were combined into new average series. Neither series was dated. One of the two large north-south beams retained complete sapwood, and was found to have been felled in winter AD 1810/11. This date is over a decade later than inscriptions on some of the other timbers, and hence appears to represent another phase of repair or rebuilding at the site.

Keywords

Dendrochronology
Standing Building

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Introduction

The grade-I listed medieval Bramford parish church (NGR TM 127 463; Fig 1) was receiving grant aid towards repairs of the spire at the time of this investigation. Tree-ring analysis of the spire and upper tower timbers which form the supporting structure below the spire was requested as part of a wider study of the structure to inform these repairs. The tower is thought to have been added *c* AD 1370 and to have been remodelled in the fifteenth century, and it was thought that the upper tower timbers may relate to one of these construction episodes. Some of these spire-supporting timbers appear to be reused medieval timbers. In addition, there are some large cross beams, some of which bear inscriptions suggesting that they are of eighteenth-century origin. The inscriptions noted were "Daniel Orford 1737", "1749", "GM1788", and "CH1796". The spire itself was thought to have been rebuilt in the eighteenth century. This investigation was requested by the local English Heritage Historic Buildings Architect, Trudi Hughes.

Figure 1: Map showing the location of St Mary's Church, Bramford (circled).

Methodology

The site was visited in July 2006. In the initial assessment, accessible oak timbers with more than 50 rings and traces of sapwood were sought, although slightly shorter sequences are sometimes sampled if little other material is available. Those building timbers judged to be potentially useful were cored using a 15mm auger attached to an electric drill. The cores were glued to wooden laths, labelled, and stored for subsequent analysis.

The cores were prepared for measuring by sanding, using an electric belt-sander with progressively finer grit papers down to 400 grit. Any further preparation necessary, eg where bands of narrow rings occurred, was done manually. Suitable samples had their tree-ring sequences measured to an accuracy of 0.01 mm, using a specially constructed system utilising a binocular microscope with the sample mounted on a travelling stage with a linear transducer linked to a PC, which recorded the ring widths into a dataset. The software used in measuring and subsequent analysis was written by Ian Tyers (2004). Cross-matching and dating was accomplished by a combination of visual matching and a process of qualified statistical comparison by computer. The ring-width series were compared for statistical cross-matching, using a variant of the Belfast CROS program (Baillie and Pilcher 1973). Ring sequences were plotted to allow visual comparisons to be made between sequences on a light table. This method provides a measure of quality control in identifying any errors in the measurements when the samples cross-match.

In comparing one sequence or site sequence against another, *t*-values over 3.5 are considered significant, although in reality it is common to find *t*-values of 4 and 5 which are demonstrably spurious because more than one matching position is indicated. For this reason, it is necessary to obtain some *t*-values of 5, 6, and higher, and for these to be well replicated with different, independent chronologies and with local and regional chronologies well represented, unless the timber is imported. Where two individual sequences match with a *t*-value of 10 or above, and visually exhibit exceptionally similar ring patterns, they may have been derived from the same parent tree.

When cross-matching between samples is found, their ring-width sequences are averaged to form an internal 'working' site mean sequence. Other samples may then be incorporated after comparison with this 'working' master until a final site sequence is established. This is then compared with a number of reference chronologies (multi-site chronologies from a region) and dated individual site masters in an attempt to date it. Individual long series which are not included in the site mean(s) are also compared with the database to see if they can be dated.

The dates thus obtained represent the time of formation of the measured rings in each sample. These dates require interpretation for the construction date of the phase under investigation to be determined. An important aspect of this interpretation is the estimate of the number of sapwood rings missing. The sapwood estimates used here are based on those proposed for this area by Miles (1997), in which 95% of oaks contain 9–41 rings. Where complete sapwood or bark is present, the exact date of tree felling may be determined.

The dates derived for the felling of the trees used in construction do not necessarily relate directly to the date of construction of the building. However, evidence suggests that, except in the reuse of timbers, construction in most historical periods took place within a very few years after felling (Salzman 1952; Hollstein 1965).

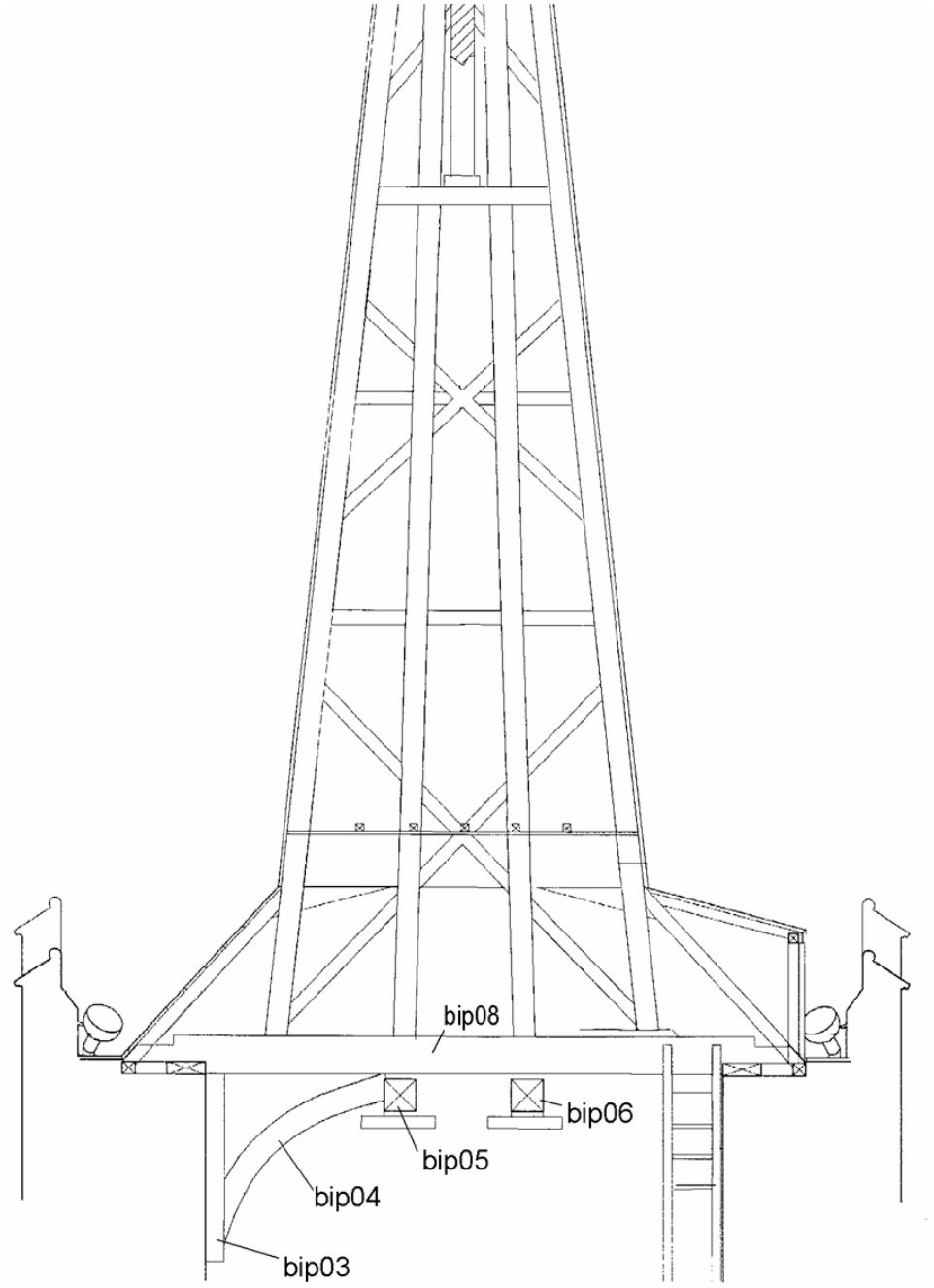

Figure 2: Section drawing of the top of the tower and the spire, looking north, showing the approximate positions of some of the timbers sampled for dendrochronology. The remaining posts, bip01, bip02, and bip07 are in the west and south walls in a similar position to bip03. Based on an original drawing by David Whymark

Results

Assessment of the timbers revealed that many had too few rings for reliable analysis. In addition few retained sapwood limiting the potential for the production of precise dating evidence. None of the spire timbers were sampled. Cores were however taken from a number of the upper tower timbers, details of which are given in Table 1, with some of their positions being illustrated in Figure 2. No drawing of the supporting structure was available, but other posts are in a similar position to bip03 on other walls. Although the spire supporting structure was thought to be composed of a mixture of reused medieval and primary-use post-medieval timbers, few were assessed as having sufficient rings and the sampling only looked at the most promising individuals, which did not include a representative number of each group. It was felt however that some information would be gained from the few timbers sampled, and the opportunity was therefore taken whilst easy access was possible.

Cross-matching was attempted between all the samples, with two pairs of samples producing significant *t*-values:

bip01 *vs* bip02, $t = 5.1$ with 62 years overlap
bip03 *vs* bip07, $t = 4.3$ with 49 years overlap

These pairs of series were combined to produce two new average series, bip0102m and bip0307m, neither of which dated.

When the new series and other individuals series were compared with dated reference material, bip06 dated independently, with its outermost complete sapwood ring having been formed in AD 1810. The dating evidence for this series is given in Table 2, and the data are given in Table 3.

Interpretation and Discussion

Trees in this region are often seen to have relatively sensitive growth patterns and many reach usable sizes within a short time. Most of the series looked at here had rather short sequences and failed to produce a replicated site master. It is also possible that the individual timbers were cut at different times, the structure probably being composed of reused medieval timbers with others that may have been added at different dates, probably in the eighteenth century. Few local chronologies are available covering this period. It was therefore a problem to decide whether sufficient material of any likely use was available to make sampling worthwhile, and in the end it was decided that limited sampling would be undertaken, although only one timber was finally dated.

The large beam that did date was felled during the winter of AD 1810/11. This makes the beam somewhat later than the dates carved on several other timbers near its position, and reveals another potential phase of alterations, repairs, or rebuilding.

Table 1: Details of oak (*Quercus* spp.) timbers sampled from the spire supporting structure of St Mary's Church, Bramford. Posts on the underframe are numbered from the north side

Sample Number	Timber and position	No of rings	Mean width (mm)	Mean sens (mm)	Dates AD Spanning	Sapwood complement	Felling seasons and dates/date ranges (AD)
bip01	Post 3, underframe, west wall	71	1.11	0.29	undated	17	unknown
bip02	Post 4, underframe, west wall	66	1.55	0.25	undated	-	unknown
bip03	Post 1, underframe, west wall	67	2.36	0.23	undated	13	unknown
bip04	Curved brace, north west corner	<45	NM	-	undated	-	unknown
bip05	West tie at top of tower	76	2.70	0.23	undated	2	unknown
bip06	East tie at top of tower	120	1.97	0.29	1691–1810	22C	winter 1810/11
bip07	Centre post, south side of spire	49	2.03	0.29	undated	H/S?	unknown
bip08	Tie on post 3	50	2.58	0.27	undated	5	unknown

NM = not measured

H/S = heartwood/sapwood boundary

Table 2: Dating evidence for the site series bip06, AD 1691–1810 (regional multi-site chronologies have the file name in **bold**)

County/ region:	*Chronology name:*	*Short publication reference:*	*File name:*	*Spanning: (yrs AD)*	*Overlap (yrs)*	*t-value*
Hampshire *	Old Basing	(Bridge 1996)	BASINGDF	1684–1788	98	6.5
Hampshire	Hampshire Master Chronology	(Miles 2003)	**HANTS02**	443–1972	120	6.5
Southern England	Southern England Master	(Bridge 1998)	**SENG98**	944–1790	100	6.4
Southern England	HMS Victory	(Barefoot 1978)	VICTORY	1640–1800	110	6.0
Oxfordshire	Chazey Court	(Miles *et al* 2004)	CHAZEY2	1674–1737	47	5.3
Hampshire	Sadlers Mill House, Romsey	(Miles *et al* 2006)	SADLERS	1650–1747	57	5.2
Somerset	Somerset Master Chronology	(Miles 2004)	**SOMRST04**	770–1979	120	5.0
Leicestershire	Church Farm, Bringhurst	(Groves *et al* 2004)	BRNGHST1	1664–1781	91	5.0

* = component of SENG98 and HANTS02

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Table 3: Ring width data for the dated site series bip06 from St Mary's Church, Bramford

Ring widths (0.01mm)									
bip06 AD 1691–1810									
273	262	303	261	293	374	330	371	254	363
398	446	491	312	268	359	368	381	330	205
343	409	600	367	459	332	425	272	216	284
324	399	247	382	269	454	280	185	162	124
190	235	212	185	243	189	171	108	186	235
142	83	155	78	156	220	200	199	110	107
105	194	146	185	121	133	134	121	121	119
131	79	225	180	100	93	120	156	142	134
100	69	129	140	140	189	131	118	62	70
60	162	91	68	100	83	149	102	180	123
120	176	106	58	80	59	88	78	112	116
114	57	51	106	142	99	151	127	113	78